

FIGURE 1

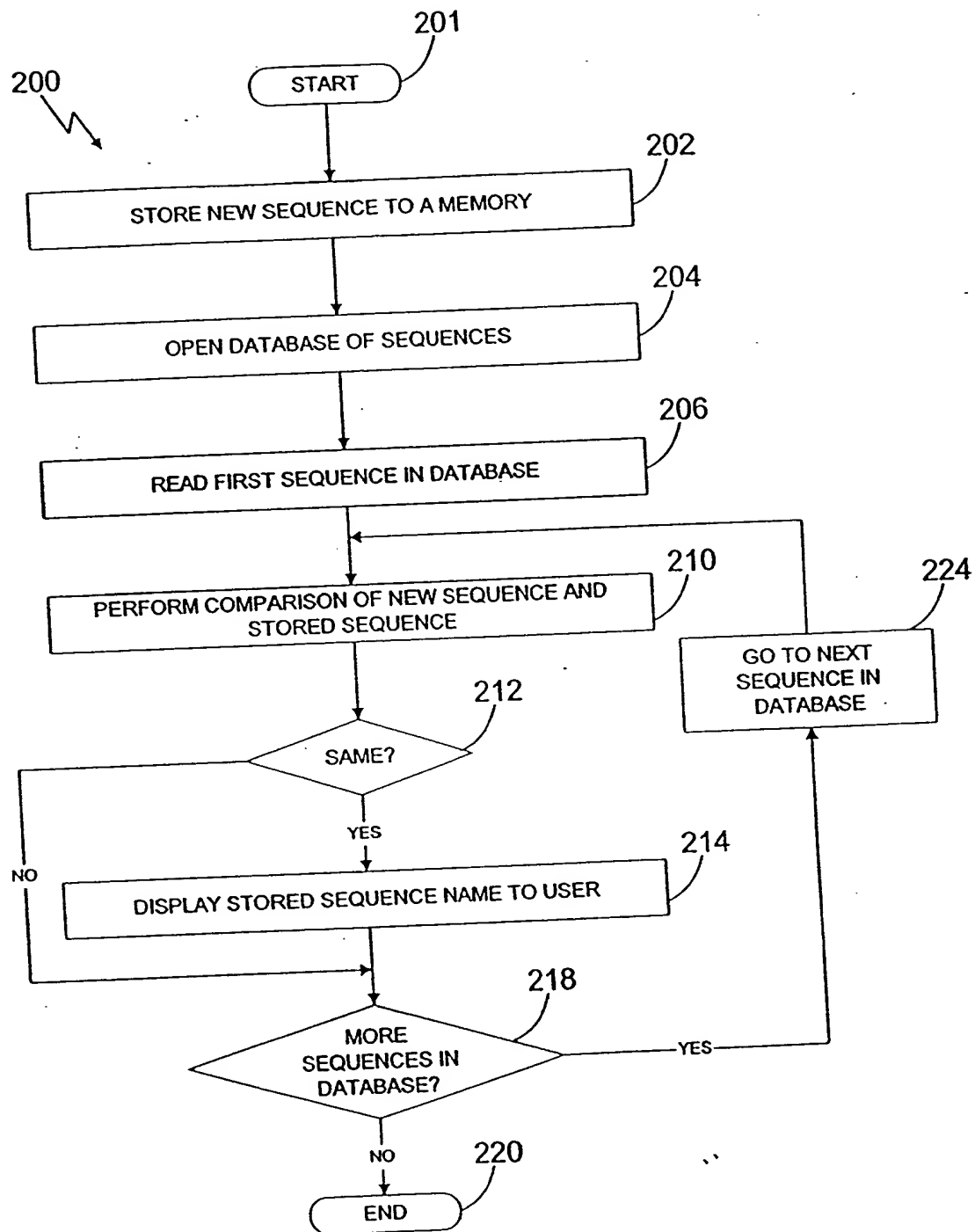


FIGURE 2

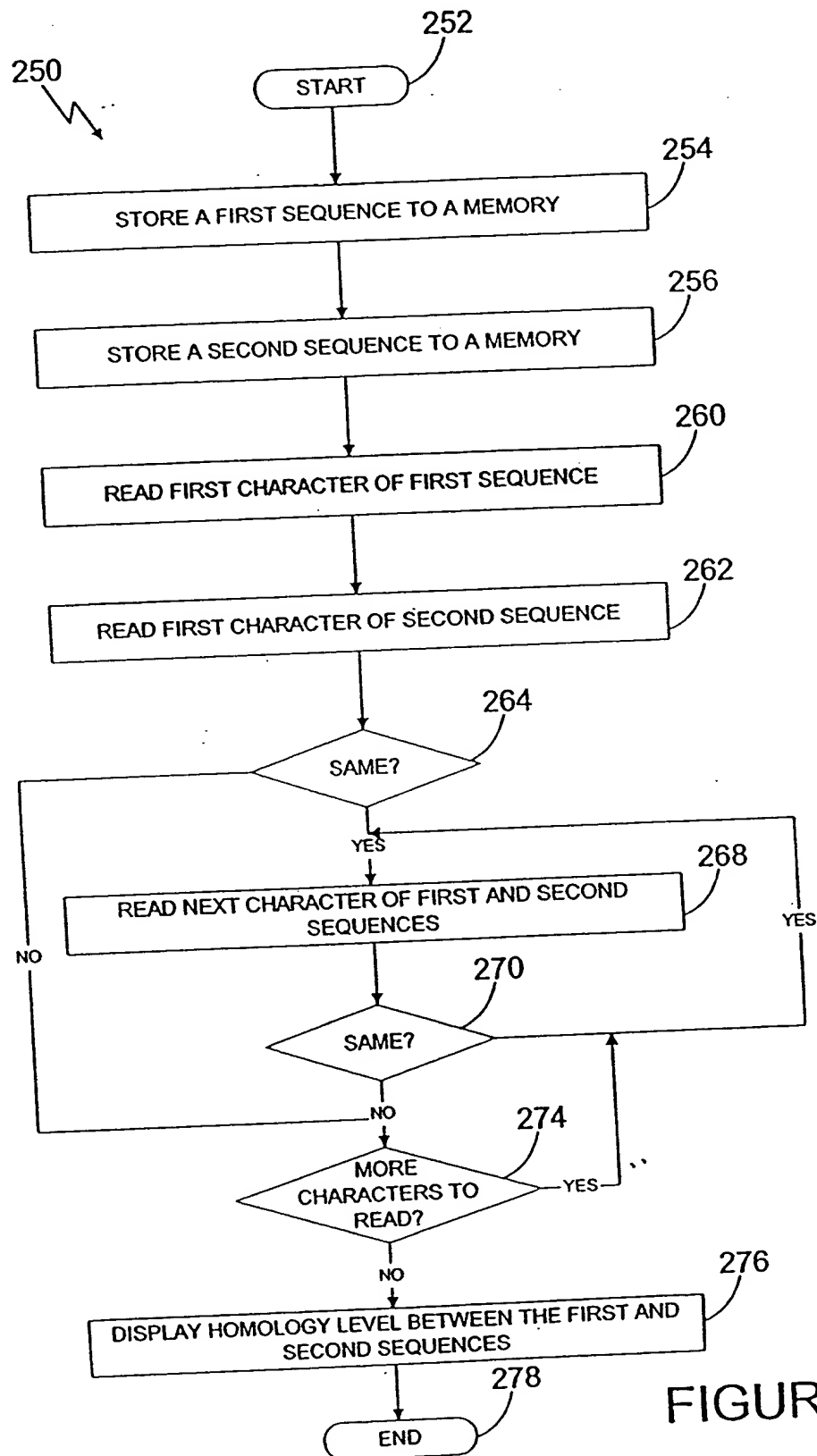


FIGURE 3

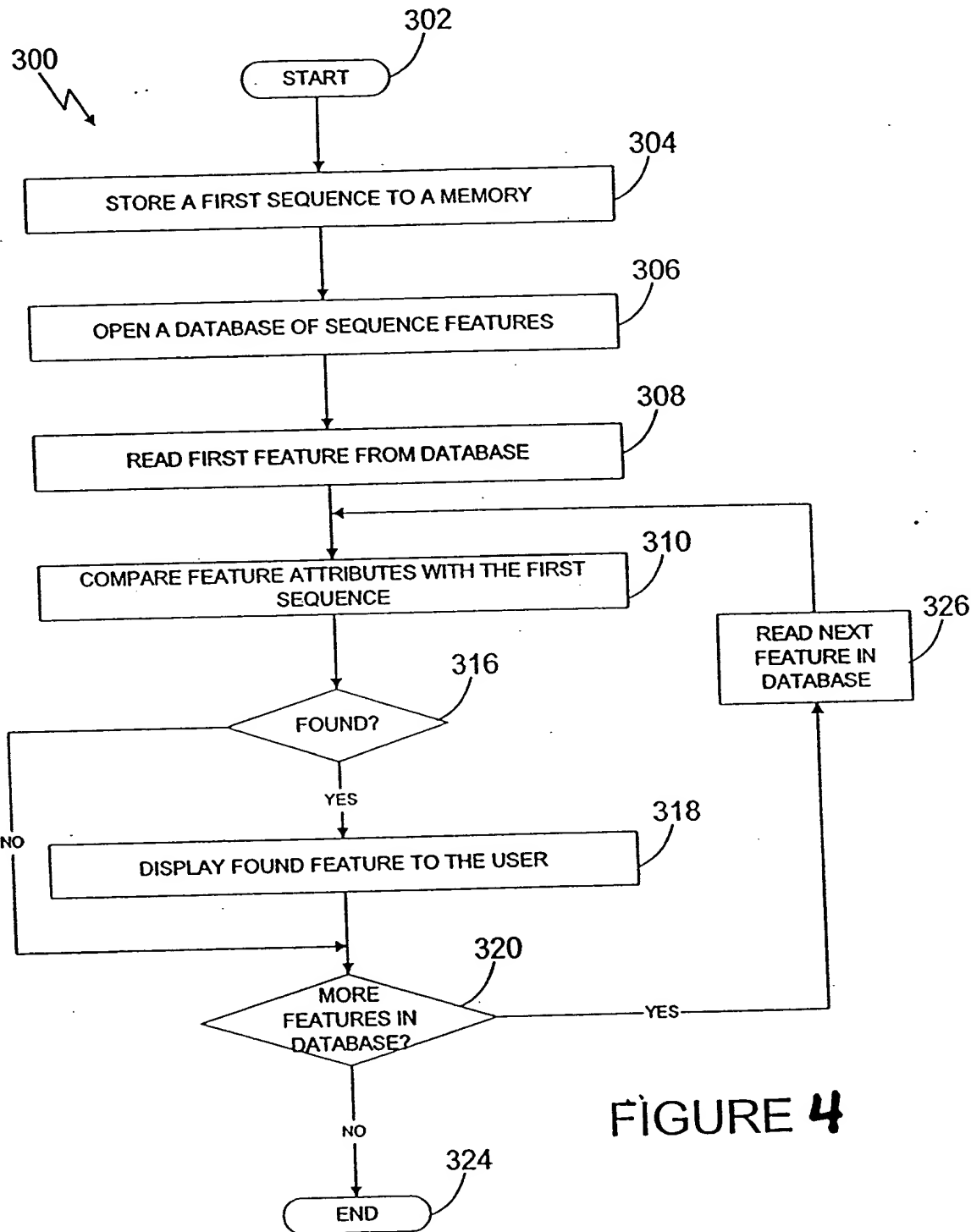


FIGURE 4

FIGURE 5

ATG ATT GAA GAC CCT ATG GAC TGG GCT TTT CCG AGG ATA AAG AGA CTG Met Ile Glu Asp Pro Met Asp Trp Ala Phe Pro Arg Ile Lys Arg Leu	48
5 10 15	
CCT CAG TAT GTC TTC TCT CTC GTT AAC GAA CTC AAG TAC AAG CTA AGG Pro Gln Tyr Val Phe Ser Leu Val Asn Glu Leu Lys Tyr Lys Leu Arg	96
20 25 30	
CGT GAA GGC GAA GAT GTA GTG GAT CTT GGT ATG GGC AAT CCT AAC ATG Arg Glu Gly Glu Asp Val Val Asp Leu Gly Met Gly Asn Pro Asn Met	144
35 40 45	
CCT CCA GCA AAG CAC ATA ATA GAT AAA CTC TGC GAA GTG GCT CAA AAG Pro Pro Ala Lys His Ile Ile Asp Lys Leu Cys Glu Val Ala Gln Lys	192
50 55 60	
CCG AAC GTT CAC GGA TAT TCT GCG TCA AGG GGC ATA CCA AGA CTG AGA Pro Asn Val His Gly Tyr Ser Ala Ser Arg Gly Ile Pro Arg Leu Arg	240
65 70 75 80	
AAG GCT ATA TGT AAC TTC TAC GAA GAA AGG TAC GGA GTG AAA CTC GAC Lys Ala Ile Cys Asn Phe Tyr Glu Glu Arg Tyr Gly Val Lys Leu Asp	288
85 90 95	
CCT GAG AGG GAG GCT ATA CTA ACA ATC GGT GCA AAG GAA GGG TAT TCT Pro Glu Arg Glu Ala Ile Leu Thr Ile Gly Ala Lys Glu Gly Tyr Ser	336
100 105 110	
CAT TTG ATG CTT GCG ATG ATA TCT CCG GGT GAT ACG GTA ATA GTT CCT His Leu Met Leu Ala Met Ile Ser Pro Gly Asp Thr Val Ile Val Pro	384
115 120 125	
AAT CCC ACC TAT CCT ATT CAC TAT TAC GCT CCC ATA ATT GCA GGA GGG Asn Pro Thr Tyr Pro Ile His Tyr Tyr Ala Pro Ile Ile Ala Gly Gly	432
130 135 140	
GAA GTT CAC TCA ATA CCC CTT AAC TTC TCG GAC GAT CAA GAT CAT CAG Glu Val His Ser Ile Pro Leu Asn Phe Ser Asp Asp Gln Asp His Gln	480
145 150 155 160	
GAA GAG TTT TTA AGG AGG CTT TAC GAG ATA GTA AAA ACC GCG ATG CCA Glu Glu Phe Leu Arg Arg Leu Tyr Glu Ile Val Lys Thr Ala Met Pro	528
165 170 175	
AAA CCC AAG GCT GTC GTC ATA AGC TTT CCT CAC AAT CCA ACG ACC ATA Lys Pro Lys Ala Val Val Ile Ser Phe Pro His Asn Pro Thr Thr Ile	576
180 185 190	
ACG GTA GAA AAG GAC TTT TTT AAA GAA ATA GTT AAG TTT GCA AAG GAA Thr Val Glu Lys Asp Phe Phe Lys Glu Ile Val Lys Phe Ala Lys Glu	624
195 200 205	
CAC GGT CTC TGG ATA ATA CAC GAT TTT GCG TAT GCG GAT ATA GCC TTT His Gly Leu Trp Ile Ile His Asp Phe Ala Tyr Ala Asp Ile Ala Phe	672
210 215 220	
GAC GGT TAC AAG CCC CCC TCA ATA CTC GAA ATA GAA GGT GCT AAA GAC Asp Gly Tyr Lys Pro Pro Ser Ile Leu Glu Ile Glu Gly Ala Lys Asp	720
225 230 235 240	
GTT GCG GTT GAG CTC TAC TCC ATG TCA AAG GGC TTT TCA ATG GCG GGC Val Ala Val Glu Leu Tyr Ser Met Ser Lys Gly Phe Ser Met Ala Gly	768

245	250	255	
TGG AGG GTA GCC TTT GTC GTT GGA AAC GAA ATA CTC ATA AAA AAC CTT Trp Arg Val Ala Phe Val Val Gly Asn Glu Ile Leu Ile Lys Asn Leu 260 265 270			816
GCA CAC CTC AAA AGC TAC TTG GAT TAC GGT ATA TTT ACT CCC ATA CAG Ala His Leu Lys Ser Tyr Leu Asp Tyr Gly Ile Phe Thr Pro Ile Gln 275 280 285			864
GTG GCC TCT ATT ATC GCA TTA GAG AGC CCC TAC GAA ATC GTG GAA AAA Val Ala Ser Ile Ile Ala Leu Glu Ser Pro Tyr Glu Ile Val Glu Lys 290 295 300			912
ACC GCA AAG GTT TAC CAA AAA AGA AGA GAC GTT CTG GTG GAA GGG TTA Thr Ala Lys Val Tyr Gln Lys Arg Arg Asp Val Leu Val Glu Gly Leu 305 310 315 320			960
AAC AGG CTC GGC TGG AAA GTA AAA AAA CCT AAG GCT ACC ATG TTC GTC Asn Arg Leu Gly Trp Lys Val Lys Lys Pro Lys Ala Thr Met Phe Val 325 330 335			1008
TGG GCA AAG ATT CCC GAA TGG ATA AAT ATG AAC TCT CTG GAC TTT TCC Trp Ala Lys Ile Pro Glu Trp Ile Asn Met Asn Ser Leu Asp Phe Ser 340 345 350			1056
TTG TTC CTC CTA AAA GAG GCG AAG GTT GCG GTA TCC CCG GGT GTG GGC Leu Phe Leu Leu Lys Glu Ala Lys Val Ala Val Ser Pro Gly Val Gly 355 360 365			1104
TTT GGT CAG TAC GGA GAG GGG TAC GTA AGG TTT GCA CTT GTA GAA AAT Phe Gly Gln Tyr Gly Glu Gly Tyr Val Arg Phe Ala Leu Val Glu Asn 370 375 380			1152
GAA CAC AGG ATC AGA CAG GCT ATA AGG GGA ATA AGG AAA GCC TTC AGA Glu His Arg Ile Arg Gln Ala Ile Arg Gly Ile Arg Lys Ala Phe Arg 385 390 395 400			1200
AAA CTC CAG AAG GAG AGG AAA CTT GAA CCT GAG AGA AGT GCT TAA Lys Leu Gln Lys Glu Arg Lys Leu Glu Pro Glu Arg Ser Ala End 405 410 414			1245

FIGURE 6

ATG GAC AGG CTT GAA AAA GTA TCA CCC TTC ATA GTA ATG GAT ATC CTA	48
Met Asp Arg Leu Glu Lys Val Ser Pro Phe Ile Val Met Asp Ile Leu	
5 10 15	
GCT CAG GCC CAG AAG TAC GAA GAC GTA GTA CAC ATG GAG ATA GGA GAG	96
Ala Gln Ala Gln Lys Tyr Glu Asp Val Val His Met Glu Ile Gly Glu	
20 25 30	
CCC GAT TTA GAA CCG TCT CCC AAG GTA ATG GAA GCT CTG GAA CGT GCG	144
Pro Asp Leu Glu Pro Ser Pro Lys Val Met Glu Ala Leu Glu Arg Ala	
35 40 45	
GTG AAG GAA AAG ACG TTC TTC TAC ACC CCT GCT CTG GGA CTC TGG GAA	192
Val Lys Glu Lys Thr Phe Phe Tyr Thr Pro Ala Leu Gly Leu Trp Glu	
50 55 60	
CTC AGG GAA AGG ATA TCG GAG TTT TAC AGG AAA AAG TAC AGC GTT GAA	240
Leu Arg Glu Arg Ile Ser Glu Phe Tyr Arg Lys Lys Tyr Ser Val Glu	
65 70 75 80	
GTT TCT CCA GAG AGA GTC ATC GTA ACT ACC GGA ACT TCG GGA GCG TTT	288
Val Ser Pro Glu Arg Val Ile Val Thr Thr Gly Thr Ser Gly Ala Phe	
85 90 95	
CTC GTA GCC TAC GCC GTA ACA CTA AAT GCG GGA GAG AAG ATA ATC CTC	336
Leu Val Ala Tyr Ala Val Thr Leu Asn Ala Gly Glu Lys Ile Ile Leu	
100 105 110	
CCA GAC CCC TCT TAC CCC TGT TAC AAA AAC TTT GCC TAC CTC TTA GAC	384
Pro Asp Pro Ser Tyr Pro Cys Tyr Lys Asn Phe Ala Tyr Leu Leu Asp	
115 120 125	
GCT CAG CCG GTT TTC GTA AAC GTT GAC AAG GAA ACG AAT TAC GAA GTA	432
Ala Gln Pro Val Phe Val Asn Val Asp Lys Glu Thr Asn Tyr Glu Val	
130 135 140	
AGG AAA GAG ATG ATA GAA GAC ATT GAT GCG AAA GCC CTT CAC ATT TCC	480
Arg Lys Glu Met Ile Glu Asp Ile Asp Ala Lys Ala Leu His Ile Ser	
145 150 155 160	
TCG CCT CAA AAC CCT ACG GGC ACA CTC TAC TCA CCT GAA ACC CTG AAG	528
Ser Pro Gln Asn Pro Thr Gly Thr Leu Tyr Ser Pro Glu Thr Leu Lys	
165 170 175	
GAA CTT GCG GAG TAC TGC GAA GAG AAG GGT ATG TAC TTC ATA TCC GAC	576
Glu Leu Ala Glu Tyr Cys Glu Glu Lys Gly Met Tyr Phe Ile Ser Asp	
180 185 190	
GAG ATT TAC CAC GGA CTC GTT TAC GAA GGT AGG GAG CAC ACA GCA CTT	624
Glu Ile Tyr His Gly Leu Val Tyr Glu Gly Arg Glu His Thr Ala Leu	
195 200 205	
GAG TTC TCT GAC AGG GCT ATT GTC ATA AAC GGG TTT TCT AAG TAC TTC	672
Glu Phe Ser Asp Arg Ala Ile Val Ile Asn Gly Phe Ser Lys Tyr Phe	
210 215 220	
TGT ATG CCA GGT TTC AGG ATA GGG TGG ATG ATA GTT CCG GAA GAA CTC	720
Cys Met Pro Gly Phe Arg Ile Gly Trp Met Ile Val Pro Glu Glu Leu	
225 230 235 240	
GTG AGA AAG GCG GAA ATA GTA ATT CAG AAC GTA TTT ATA TCT GCC CCG	768
Val Arg Lys Ala Glu Ile Val Ile Gln Asn Val Phe Ile Ser Ala Pro	
245 250 255	

FIGURE 7

ATG TGG GAA TTA GAC CCT AAA ACG CTC GAA AAG TGG GAC AAG GAG TAC Met Trp Glu Leu Asp Pro Lys Thr Leu Glu Lys Trp Asp Lys Glu Tyr	48
5 10 15	
TTC TGG CAT CCA TTT ACC CAG ATG AAA GTC TAC AGA GAA GAA GAA AAC Phe Trp His Pro Phe Thr Gln Met Lys Val Tyr Arg Glu Glu Glu Asn	96
20 25 30	
CTG ATA TTT GAA CGC GGA GAA GGC GTT TAC CTG TGG GAC ATA TAC GGC Leu Ile Phe Glu Arg Gly Glu Gly Val Tyr Leu Trp Asp Ile Tyr Gly	144
35 40 45	
AGG AAG TAT ATA GAT GCC ATA TCT TCC CTC TGG TGC AAC GTC CAC GGA Arg Lys Tyr Ile Asp Ala Ile Ser Ser Leu Trp Cys Asn Val His Gly	192
50 55 60	
CAT AAC CAC CCT AAA CTG AAC AAC GCA GTT ATG AAA CAG CTC TGT AAG His Asn His Pro Lys Leu Asn Asn Ala Val Met Lys Gln Leu Cys Lys	240
65 70 75 80	
GTA GCT CAC ACA ACT ACT CTG GGA AGT TCC AAC GTT CCC GCC ATA CTC Val Ala His Thr Thr Thr Leu Gly Ser Ser Asn Val Pro Ala Ile Leu	288
85 90 95	
CTT GCA AAG AAG CTT GTA GAA ATT TCT CCT GAA GGA TTA AAC AAG GTC Leu Ala Lys Lys Leu Val Glu Ile Ser Pro Glu Gly Leu Asn Lys Val	336
100 105 110	
TTT TAC TCC GAA GAC GGT GCG GAA GCA GTA GAG ATA GCG ATA AAG ATG Phe Tyr Ser Glu Asp Gly Ala Glu Ala Val Glu Ile Ala Ile Lys Met	384
115 120 125	
GCT TAT CAC TAC TGG AAG AAC AAG GGA GTT AAA GGG AAA AAC GTT TTC Ala Tyr His Tyr Trp Lys Asn Lys Gly Val Lys Gly Lys Asn Val Phe	432
130 135 140	
ATA ACG CTT TCC GAA GCC TAC CAC GGG GAT ACT GTA GGA GCG GTT AGC Ile Thr Leu Ser Glu Ala Tyr His Gly Asp Thr Val Gly Ala Val Ser	480
145 150 155 160	
GTA GGG GGT ATA GAA CTC TTC CAC GGA ACT TAT AAA GAT CTC CTT TTC Val Gly Gly Ile Glu Leu Phe His Gly Thr Tyr Lys Asp Leu Leu Phe	528
165 170 175	
AAG ACT ATA AAA CTC CCA TCT CCT TAC CTG TAC TGC AAG GAA AAG TAC Lys Thr Ile Lys Leu Pro Ser Pro Tyr Leu Tyr Cys Lys Glu Lys Tyr	576
180 185 190	
GGG GAA CTC TGC CCT GAG TGC ACG GCA GAT TTA TTA AAA CAA CTG GAA Gly Glu Leu Cys Pro Glu Cys Thr Ala Asp Leu Leu Lys Gln Leu Glu	624
195 200 205	
GAT ATC CTG AAG TCG CGG GAA GAT ATC GTT GCG GTC ATT ATG GAA GCG Asp Ile Leu Lys Ser Arg Glu Asp Ile Val Ala Val Ile Met Glu Ala	672
210 215 220	
GGA ATT CAG GCA GCC GCG GGA ATG CTC CCC TTC CCT CCG GGA TTT TTG Gly Ile Gln Ala Ala Ala Gly Met Leu Pro Phe Pro Pro Gly Phe Leu	720
225 230 235 240	
AAA GGC GTA AGG GAG CTT ACG AAG AAA TAC GAC ACT TTA ATG ATA GTT Lys Gly Val Arg Glu Leu Thr Lys Lys Tyr Asp Thr Leu Met Ile Val	768
245 250 255	

GAC GAG GTT GCC ACG GGA TTT GGC AGG ACG GGA ACG ATG TTT TAC TGT Asp Glu Val Ala Thr Gly Phe Gly Arg Thr Gly Thr Met Phe Tyr Cys 260 265 270	816
GAG CAG GAA GGA GTC AGT CCG GAC TTT ATG TGT CTA GGT AAG GGT ATA Glu Gln Glu Gly Val Ser Pro Asp Phe Met Cys Leu Gly Lys Gly Ile 275 280 285	864
ACC GGA GGG TAC CTC CCG CTT GCT GCG ACA CTC ACA ACG GAC GAG GTG Thr Gly Gly Tyr Leu Pro Leu Ala Ala Thr Leu Thr Thr Asp Glu Val 290 295 300	912
TTC AAT GCC TTT TTA GGT GAG TTC GGG GAG GCA AAG CAC TTT TAC CAC Phe Asn Ala Phe Leu Gly Glu Phe Gly Glu Ala Lys His Phe Tyr His 305 310 315 320	960
GGG CAC ACC TAC ACT GGA AAT AAC CTC GCC TGT TCC GTT GCA CTC GCA Gly His Thr Tyr Thr Gly Asn Asn Leu Ala Cys Ser Val Ala Leu Ala 325 330 335	1008
AAC TTA GAA GTT TTT GAG GAA GAA AGA ACT TTA GAG AAG CTC CAA CCA Asn Leu Glu Val Phe Glu Glu Glu Arg Thr Leu Glu Lys Leu Gln Pro 340 345 350	1056
AAG ATA AAG CTT TTA AAG GAA AGG CTT CAG GAG TTC TGG GAA CTC AAG Lys Ile Lys Leu Leu Lys Glu Arg Leu Gln Glu Phe Trp Glu Leu Lys 355 360 365	1104
CAC GTT GGA GAT GTT AGA CAG CTA GGT TTT ATG GCT GGA ATA GAG CTG His Val Gly Asp Val Arg Gln Leu Gly Phe Met Ala Gly Ile Glu Leu 370 375 380	1152
GTG AAG GAC AAA GAA AAG GGA GAA CCT TTC CCT TAC GGT GAA AGG ACG Val Lys Asp Lys Glu Lys Gly Glu Pro Phe Pro Tyr Gly Glu Arg Thr 385 390 395 400	1200
GGA TTT AAG GTG GCT TAC AAG TGC AGG GAA AAA GGG GTG TTT TTG AGA Gly Phe Lys Val Ala Tyr Lys Cys Arg Glu Lys Gly Val Phe Leu Arg 405 410 415	1245
CCG CTC GGA GAC GTT ATG GTA TTG ATG ATG CCT CTT GTA ATA GAG GAA Pro Leu Gly Asp Val Met Val Leu Met Met Pro Leu Val Ile Glu Glu 420 425 430	1293
GAC GAA ATG AAC TAC GTT ATT GAT ACA CTT AAA TGG GCA ATT AAA GAG Asp Glu Met Asn Tyr Val Ile Asp Thr Leu Lys Trp Ala Ile Lys Glu 435 440 445	1341
CTT GAA AAA GAG GTG TAG Leu Glu Lys Glu Val End 450	1359

THE
NEW
YORK
PUBLIC
LIBRARY

ATG ACA TAC TTA ATG AAC AAT TAC GCA AGG TTG CCC GTA AAG TTT GTA	48
Met Thr Tyr Leu Met Asn Asn Tyr Ala Arg Leu Pro Val Lys Phe Val	
5 10 15	
AGG GGA AAA GGT GTT TAC CTG TAC GAT GAG GAA GGA AAG GAG TAT CTT	96
Arg Gly Lys Gly Val Tyr Leu Tyr Asp Glu Glu Gly Lys Glu Tyr Leu	
20 25 30	
GAC TTT GTC TCC GGT ATA GGC GTC AAC TCC CTC GGT CAC GCT TAC CCA	144
Asp Phe Val Ser Gly Ile Gly Val Asn Ser Leu Gly His Ala Tyr Pro	
35 40 45	
AAA CTC ACA GAA GCT CTA AAA GAA CAG GTT GAG AAA CTC CTC CAC GTT	192
Lys Leu Thr Glu Ala Leu Lys Glu Gln Val Glu Lys Leu Leu His Val	
50 55 60	
TCA AAT CTT TAC GAA AAC CCG TGG CAG GAA GAA CTG GCT CAC AAA CTT	240
Ser Asn Leu Tyr Glu Asn Pro Trp Gln Glu Glu Leu Ala His Lys Leu	
65 70 75 80	
GTA AAA CAC TTC TGG ACA GAA GGG AAG GTA TTT TTC GCA AAC AGC GGA	288
Val Lys His Phe Trp Thr Glu Gly Lys Val Phe Phe Ala Asn Ser Gly	
85 90 95	
ACG GAA AGT GTA GAG GCG GCT ATA AAG CTC GCA AGG AAG TAC TGG AGG	336
Thr Glu Ser Val Glu Ala Ala Ile Lys Leu Ala Arg Lys Tyr Trp Arg	
100 105 110	
GAT AAA GGA AAG AAC AAG TGG AAG TTT ATA TCC TTT GAA AAC TCT TTC	384
Asp Lys Gly Lys Asn Lys Trp Lys Phe Ile Ser Phe Glu Asn Ser Phe	
115 120 125	
CAC GGG AGA ACC TAC GGT AGC CTC TCC GCA ACG GGA CAG CCA AAG TTC	432
His Gly Arg Thr Tyr Gly Ser Leu Ser Ala Thr Gly Gln Pro Lys Phe	
130 135 140	
CAC AAA GGC TTT GAA CCT CTA GTT CCT GGA TTT TCT TAC GCA AAG CTG	480
His Lys Gly Phe Glu Pro Leu Val Pro Gly Phe Ser Tyr Ala Lys Leu	
145 150 155 160	
AAC GAT ATA GAC AGC GTT TAC AAA CTC CTA GAC GAG GAA ACC GCG GGG	528
Asn Asp Ile Asp Ser Val Tyr Lys Leu Leu Asp Glu Glu Thr Ala Gly	
165 170 175	
ATA ATT ATT GAA GTT ATA CAA GGA GAG GGC GGA GTA AAC GAG GCG AGT	576
Ile Ile Ile Glu Val Ile Gln Gly Glu Gly Gly Val Asn Glu Ala Ser	
180 185 190	
GAG GAT TTT CTA AGT AAA CTC CAG GAA ATT TGT AAA GAA AAA GAT GTG	624
Glu Asp Phe Leu Ser Lys Leu Gln Glu Ile Cys Lys Glu Lys Asp Val	
195 200 205	
CTC TTA ATT ATA GAC GAA GTG CAA ACG GGA ATA GGA AGG ACC GGG GAA	672
Leu Leu Ile Ile Asp Glu Val Gln Thr Gly Ile Gly Arg Thr Gly Glu	
210 215 220	
TTC TAC GCA TAT CAA CAC TTC AAT CTA AAA CCG GAC GTA ATT GCG CTT	720
Phe Tyr Ala Tyr Gln His Phe Asn Leu Lys Pro Asp Val Ile Ala Leu	
225 230 235 240	
GCG AAG GGA CTC GGA GGA GGT GTG CCA ATA GGT GCC ATC CTT GCA AGG	768
Ala Lys Gly Leu Gly Gly Gly Val Pro Ile Gly Ala Ile Leu Ala Arg	

FIGURE 9

ATG CGG AAA CTG GCC GAG CGG GCG CAG AAA CTG AGC CCC TCT CCC ACC	48
Met Arg Lys Leu Ala Glu Arg Ala Gln Lys Leu Ser Pro Ser Pro Thr	
5 10 15	
CTC TCG GTG GAC ACC AAG GCC AAG GAG CTT TTG CGG CAG GGG GAA AGG	96
Leu Ser Val Asp Thr Lys Ala Lys Glu Leu Leu Arg Gln Gly Glu Arg	
20 25 30	
GTC ATC AAT TTC GGG GCG GGG GAG CCG GAC TTC GAT ACA CCG GAA CAC	144
Val Ile Asn Phe Gly Ala Gly Glu Pro Asp Phe Asp Thr Pro Glu His	
35 40 45	
ATC AAG GAA GCG GCG AAG CGA GCT TTA GAT CAG GGC TTC ACC AAG TAC	192
Ile Lys Glu Ala Ala Lys Arg Ala Leu Asp Gln Gly Phe Thr Lys Tyr	
50 55 60	
ACG CCG GTG GCT GGG ATC TTA CCT CTT CGG GAG GCC ATA TGC GAG AAG	240
Thr Pro Val Ala Gly Ile Leu Pro Leu Arg Glu Ala Ile Cys Glu Lys	
65 70 75 80	
CTT TAC CGC GAC AAT CAA CTG GAA TAC AGC CCG AAT GAG ATC GTG GTC	288
Leu Tyr Arg Asp Asn Gln Leu Glu Tyr Ser Pro Asn Glu Ile Val Val	
85 90 95	
TCC TGT GGC GCC AAG CAT TCT ATT TTC AAC GCT CTG CAG GTC CTC CTG	336
Ser Cys Gly Ala Lys His Ser Ile Phe Asn Ala Leu Gln Val Leu Leu	
100 105 110	
GAC CCG GGG GAC GAG GTG ATA ATC CCC GTC CCC TAC TGG ACT TCC TAT	384
Asp Pro Gly Asp Glu Val Ile Ile Pro Val Pro Tyr Trp Thr Ser Tyr	
115 120 125	
CCG GAG CAG GTG AAG CTG GCG GGA GGG GTG CCG GTT TTC GTC CCC ACC	432
Pro Glu Gln Val Lys Leu Ala Gly Gly Val Pro Val Phe Val Pro Thr	
130 135 140	
TCT CCC GAG AAC GAC TTC AAG CTC AGG CCG GAA GAT CTA CGT GCG GCT	480
Ser Pro Glu Asn Asp Phe Lys Leu Arg Pro Glu Asp Leu Arg Ala Ala	
145 150 155 160	
GTA ACC CCG CGC ACC CGC CTT TTG ATC CTC AAT TCC CCG GCC AAC CCC	528
Val Thr Pro Arg Thr Arg Leu Leu Ile Leu Asn Ser Pro Ala Asn Pro	
165 170 175	
ACA GGC ACC GTT TAC CGC CGG GAG GAA CTT ATC GGC TTA GCG GAG GTA	576
Thr Gly Thr Val Tyr Arg Arg Glu Glu Leu Ile Gly Leu Ala Glu Val	
180 185 190	
GCC CTG GAG GCC GAC CTA TGG ATC TTG TCG GAC GAG ATC TAC GAA AAG	624
Ala Leu Glu Ala Asp Leu Trp Ile Leu Ser Asp Glu Ile Tyr Glu Lys	
195 200 205	
CTG ATC TAC GAC GGG ATG GAG CAC GTG AGC ATA GCC GCG CTC GAC CCG	672
Leu Ile Tyr Asp Gly Met Glu His Val Ser Ile Ala Ala Leu Asp Pro	
210 215 220	
GAG GTC AAA AAG CGC ACG ATT GTG GTA AAC GGT GTT TCC AAG GCT TAC	720
Glu Val Lys Lys Arg Thr Ile Val Val Asn Gly Val Ser Lys Ala Tyr	
225 230 235 240	
GCC ATG ACC GGT TGG CGC ATA GGT TAT GCT GCC GCT CCC CCG CCG ATA	768
Ala Met Thr Gly Trp Arg Ile Gly Tyr Ala Ala Ala Pro Arg Pro Ile	
245 250 255	

GCC Ala	CAG Gln	GCC Ala	ATG Met 260	ACC Thr	AAC Asn	CTC Leu	CAA Gln	AGC Ser 265	CAC His	AGT Ser	ACC Thr	TCT Ser	AAC Asn 270	CCC Pro	ACT Thr	816
TCC Ser	GTA Val	GCC Ala 275	CAG Gln	GCG Ala	GCG Ala	GCG Ala	CTG Leu 280	GCC Ala	GCT Ala	CTG Leu	AAG Lys	GGG Gly 285	CCA Pro	CAA Gln	GAG Glu	864
CCG Pro	GTG Val 290	GAG Glu	AAC Asn	ATG Met	CGC Arg	CGG Arg 295	GCT Ala	TTT Phe	CAA Gln	AAG Lys	CGG Arg 300	CGG Arg	GAT Asp	TTC Phe	ATC Ile	912
TGG Trp 305	CAG Gln	TAC Tyr	CTA Leu	AAC Asn	TCC Ser 310	TTA Leu	CCC Pro	GGA Gly	GTG Val	CGC Arg 315	TGC Cys	CCC Pro	AAA Lys	CCT Pro	TTA Leu 320	960
GGG Gly	GCC Ala	TTT Phe	TAC Tyr 325	GTC Val	TTT Phe	CCA Pro	GAA Glu	GTT Val	GAG Glu 330	CGG Arg	GCT Ala	TTT Phe	GGG Gly 335	CCG Pro	CCG Pro	1008
TCT Ser	AAA Lys	AGG Arg	ACG Thr 340	GGA Gly	AAT Asn	ACT Thr	ACC Thr	GCT Ala 345	AGC Ser	GAC Asp	CTG Leu	GCC Ala 350	CTT Leu	TTC Phe	CTC Leu	1056
CTG Leu	GAA Glu	GAG Glu 355	ATA Ile	AAA Lys	GTG Val	GCC Ala	ACC Thr 360	GTG Val	GCT Ala	GGG Gly	GCT Ala	GCC Ala 365	TTT Phe	GGG Gly	GAC Asp	1104
GAT Asp 370	CGC Arg	TAC Tyr	CTG Leu	CGC Arg	TTT Phe	TCC Ser 375	TAC Tyr	GCC Ala	CTG Leu	CGG Arg	CTG Leu 380	GAA Glu	GAT Asp	ATC Ile	GAA Glu	1152
GAG Glu 385	GGG Gly	ATG Met	CAA Gln	CGG Arg	TTT Phe 390	AAA Lys	GAA Glu	TTG Leu	ATC Ile	GAA Glu 395	GCG Ala	GCA Ala	CTT Leu	TAA End		1197

FIGURE 10

ATG TGC GGG ATA GTC GGA TAC GTA GGG AGG GAT TTA GCC CTT CCT ATA	48
Met Cys Gly Ile Val Gly Tyr Val Gly Arg Asp Leu Ala Leu Pro Ile	
5 10 15	
GTC CTC GGA GCT CTT GAG AGA CTC GAA TAC AGG GGT TAC GAC TCC GCG	96
Val Leu Gly Ala Leu Glu Arg Leu Glu Tyr Arg Gly Tyr Asp Ser Ala	
20 25 30	
GGA GTT GCC CTT ATA GAA GAC GGG AAA CTC ATA GTT GAA AAG AAG AAG	144
Gly Val Ala Leu Ile Glu Asp Gly Lys Leu Ile Val Glu Lys Lys Lys	
35 40 45	
GGA AAG ATA AGG GAA CTC GTT AAA GCG CTA TGG GGA AAG GAT TAC AAG	192
Gly Lys Ile Arg Glu Leu Val Lys Ala Leu Trp Gly Lys Asp Tyr Lys	
50 55 60	
GCT AAA ACG GGT ATA GGT CAC ACA CGC TGG GCA ACC CAC GGA AAG CCC	240
Ala Lys Thr Gly Ile Gly His Thr Arg Trp Ala Thr His Gly Lys Pro	
65 70 75 80	
ACG GAC GAG AAC GCC CAC CCC CAC ACC GAC GAA AAA GGT GAG TTT GCA	288
Thr Asp Glu Asn Ala His Pro His Thr Asp Glu Lys Gly Glu Phe Ala	
85 90 95	
GTA GTT CAC AAC GGG ATA ATA GAA AAC TAC TTA GAA CTA AAA GAG GAA	336
Val Val His Asn Gly Ile Ile Glu Asn Tyr Leu Glu Leu Lys Glu Glu	
100 105 110	
CTA AAG AAG GAA GGT GTA AAG TTC AGG TCC GAA ACA GAC ACA GAA GTT	384
Leu Lys Lys Glu Gly Val Lys Phe Arg Ser Glu Thr Asp Thr Glu Val	
115 120 125	
ATA GCC CAC CTC ATA GCG AAG AAC TAC AGG GGG GAC TTA CTG GAG GCC	432
Ile Ala His Leu Ile Ala Lys Asn Tyr Arg Gly Asp Leu Leu Glu Ala	
130 135 140	
GTT TTA AAA ACC GTA AAG AAA TTA AAG GGT GCT TTT GCC TTT GCG GTT	480
Val Leu Lys Thr Val Lys Lys Leu Lys Gly Ala Phe Ala Phe Ala Val	
145 150 155 160	
ATA ACG GTT CAC GAA CCA AAC AGA CTA ATA GGA GTG AAG CAG GGG AGT	528
Ile Thr Val His Glu Pro Asn Arg Leu Ile Gly Val Lys Gln Gly Ser	
165 170 175	
CCT TTA ATC GTC GGA CTC GGA GAA GGA GAA AAC TTC CTC GCT TCA GAT	576
Pro Leu Ile Val Gly Leu Gly Glu Gly Glu Asn Phe Leu Ala Ser Asp	
180 185 190	
ATT CCC GCA ATA CTT CCT TAC ACG AAA AAG ATT ATT GTT CTT GAT GAC	624
Ile Pro Ala Ile Leu Pro Tyr Thr Lys Lys Ile Ile Val Leu Asp Asp	
195 200 205	
GGG GAA ATA GCG GAC CTG ACT CCC GAC ACT GTG AAC ATT TAC AAC TTT	672
Gly Glu Ile Ala Asp Leu Thr Pro Asp Thr Val Asn Ile Tyr Asn Phe	
210 215 220	
GAG GGA GAG CCC GTT TCA AAG GAA GTA ATG ATT ACG CCC TGG GAT CTT	720
Glu Gly Glu Pro Val Ser Lys Glu Val Met Ile Thr Pro Trp Asp Leu	
225 230 235 240	
GTT TCT GCG GAA AAG GGT GGT TTT AAA CAC TTC ATG CTA AAA GAG ATA	768
Val Ser Ala Glu Lys Gly Gly Phe Lys His Phe Met Leu Lys Glu Ile	
245 250 255	

TAC	GAA	CAG	CCC	AAA	GCC	ATA	AAC	GAC	ACA	CTC	AAG	GGT	TTC	CTC	TCA	816
Tyr	Glu	Gln	Pro	Lys	Ala	Ile	Asn	Asp	Thr	Leu	Lys	Gly	Phe	Leu	Ser	
			260					265					270			
ACC	GAA	GAC	GCA	ATA	CCC	TTT	AAG	TTA	AAA	GAC	TTC	AGA	AGG	GTT	TTA	864
Thr	Glu	Asp	Ala	Ile	Pro	Phe	Lys	Leu	Lys	Asp	Phe	Arg	Arg	Val	Leu	
		275					280					285				
ATA	ATA	GCG	TGC	GGG	ACC	TCT	TAC	CAC	GCG	GGC	TTC	GTC	GGA	AAG	TAC	912
Ile	Ile	Ala	Cys	Gly	Thr	Ser	Tyr	His	Ala	Gly	Phe	Val	Gly	Lys	Tyr	
	290					295					300					
TGG	ATA	GAG	AGA	TTT	GCA	GGT	GTT	CCC	ACA	GAG	GTA	ATT	TAC	GCT	TCG	960
Trp	Ile	Glu	Arg	Phe	Ala	Gly	Val	Pro	Thr	Glu	Val	Ile	Tyr	Ala	Ser	
305					310					315					320	
GAA	TTC	AGG	TAT	GCG	GAC	GTT	CCC	GTT	TCG	GAC	AAG	GAT	ATC	GTT	ATC	1008
Glu	Phe	Arg	Tyr	Ala	Asp	Val	Pro	Val	Ser	Asp	Lys	Asp	Ile	Val	Ile	
				325					330					335		
GGA	ATT	TCC	CAG	TCA	GGA	GAG	ACC	GCT	GAC	ACA	AAG	TTT	GCC	CTT	CAG	1056
Gly	Ile	Ser	Gln	Ser	Gly	Glu	Thr	Ala	Asp	Thr	Lys	Phe	Ala	Leu	Gln	
			340					345					350			
TCC	GCA	AAG	GAA	AAG	GGA	GCC	TTT	ACC	GTG	GGA	CTC	GTA	AAC	GTA	GTG	1104
Ser	Ala	Lys	Glu	Lys	Gly	Ala	Phe	Thr	Val	Gly	Leu	Val	Asn	Val	Val	
		355					360					365				
GGA	AGT	GCC	ATA	GAC	AGG	GAG	TCG	GAC	TTT	TCC	CTT	CAC	ACA	CAT	GCG	1152
Gly	Ser	Ala	Ile	Asp	Arg	Glu	Ser	Asp	Phe	Ser	Leu	His	Thr	His	Ala	
	370					375					380					
GGA	CCC	GAA	ATA	GGC	GTG	GCG	GCT	ACA	AAG	ACC	TTC	ACC	GCA	CAG	TTC	1200
Gly	Pro	Glu	Ile	Gly	Val	Ala	Ala	Thr	Lys	Thr	Phe	Thr	Ala	Gln	Phe	
385					390				395					400		
ACC	GCA	CTC	TAC	GCC	CTT	TCG	GTA	AGG	GAA	AGT	GAG	GAG	AGG	GAA	AAT	1248
Thr	Ala	Leu	Tyr	Ala	Leu	Ser	Val	Arg	Glu	Ser	Glu	Glu	Arg	Glu	Asn	
				405				410					415			
CTA	ATA	AGA	CTC	CTT	GAA	AAG	GTT	CCA	TCA	CTC	GTT	GAA	CAA	ACA	CTG	1296
Leu	Ile	Arg	Leu	Leu	Glu	Lys	Val	Pro	Ser	Leu	Val	Glu	Gln	Thr	Leu	
			420					425					430			
AAC	ACC	GCA	GAA	GAA	GTG	GAG	AAG	GTA	GCG	GAA	AAG	TAC	ATG	AAA	AAG	1344
Asn	Thr	Ala	Glu	Glu	Val	Glu	Lys	Val	Ala	Glu	Lys	Tyr	Met	Lys	Lys	
		435					440					445				
AAA	AAC	ATG	CTT	TAC	CTC	GGA	AGG	TAC	TTA	AAT	TAC	CCC	ATA	GCG	CTG	1392
Lys	Asn	Met	Leu	Tyr	Leu	Gly	Arg	Tyr	Leu	Asn	Tyr	Pro	Ile	Ala	Leu	
	450					455										

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100

FIGURE 11

ATG ATA CCC CAG AGG ATT AAG GAA CTT GAA GCT TAC AAG ACG GAG GTC	48
Met Ile Pro Gln Arg Ile Lys Glu Leu Glu Ala Tyr Lys Thr Glu Val	
5 10 15	
ACT CCC GCC TCC GTC AGG CTT TCC TCT AAC GAA TTC CCC TAC GAC TTT	96
Thr Pro Ala Ser Val Arg Leu Ser Ser Asn Glu Phe Pro Tyr Asp Phe	
20 25 30	
CCC GAG GAG ATA AAA CAA AGG GCC TTA GAA GAA TTA AAA AAG GTT CCC	144
Pro Glu Glu Ile Lys Gln Arg Ala Leu Glu Glu Leu Lys Lys Val Pro	
35 40 45	
TTG AAC AAA TAC CCA GAC CCC GAA GCG AAA GAG TTA AAA GCG GTT CTT	192
Leu Asn Lys Tyr Pro Asp Pro Glu Ala Lys Glu Leu Lys Ala Val Leu	
50 55 60	
GCG GAT TTT TTC GGC GTT AAG GAA GAA AAT TTA GTT CTC GGT AAC GGT	240
Ala Asp Phe Phe Gly Val Lys Glu Glu Asn Leu Val Leu Gly Asn Gly	
65 70 75 80	
TCG GAC GAA CTC ATA TAC TAC CTC TCA ATA GCT ATA GGT GAA CTT TAC	288
Ser Asp Glu Leu Ile Tyr Tyr Leu Ser Ile Ala Ile Gly Glu Leu Tyr	
85 90 95	
ATA CCC GTT TAC ATA CCT GTT CCC ACC TTT CCC ATG TAC GAG ATA AGT	336
Ile Pro Val Tyr Ile Pro Val Pro Thr Phe Pro Met Tyr Glu Ile Ser	
100 105 110	
GCG AAA GTT CTC GGA AGA CCC CTC GTA AAG GTT CAA CTG GAC GAA AAC	384
Ala Lys Val Leu Gly Arg Pro Leu Val Lys Val Gln Leu Asp Glu Asn	
115 120 125	
TTT GAT ATA GAC TTA GAA AGA AGT ATT GAA TTA ATA GAG AAA GAA AAA	432
Phe Asp Ile Asp Leu Glu Arg Ser Ile Glu Leu Ile Glu Lys Glu Lys	
130 135 140	
CCC GTT CTC GGG TAC TTT GCT TAC CCA AAC AAC CCC ACG GGA AAC CTC	480
Pro Val Leu Gly Tyr Phe Ala Tyr Pro Asn Asn Pro Thr Gly Asn Leu	
145 150 155 160	
TTT TCC AGG GGA AAG ATT GAG GAG ATA AGA AAC AGG GGT GTT TTC TGT	528
Phe Ser Arg Gly Lys Ile Glu Glu Ile Arg Asn Arg Gly Val Phe Cys	
165 170 175	
GTA ATA GAC GAA GCC TAC TAT CAT TAC TCC GGA GAA ACC TTT CTG GAA	576
Val Ile Asp Glu Ala Tyr Tyr His Tyr Ser Gly Glu Thr Phe Leu Glu	
180 185 190	
GAC GCG CTC AAA AGG GAA GAT ACG GTA GTT TTG AGG ACA CTT TCA AAA	624
Asp Ala Leu Lys Arg Glu Asp Thr Val Val Leu Arg Thr Leu Ser Lys	
195 200 205	
ATC GGT ATG GCG AGT TTA AGG GTA GGG ATT TTA ATA GGG AAG GGG GAA	672
Ile Gly Met Ala Ser Leu Arg Val Gly Ile Leu Ile Gly Lys Gly Glu	
210 215 220	
ATC GTC TCA GAA ATT AAC AAG GTG AGA CTC CCC TTC AAC GTG ACC TAC	720
Ile Val Ser Glu Ile Asn Lys Val Arg Leu Pro Phe Asn Val Thr Tyr	
225 230 235 240	
CCC TCT CAG GTG ATG GCA AAA GTT CTC CTC ACG GAG GGA AGA GAA TTC	768
Pro Ser Gln Val Met Ala Lys Val Leu Leu Thr Glu Gly Arg Glu Phe	
245 250 255	

FIGURE 12

ATG AAG CCG TAC GCT AAA TAT ATC TGG CTT GAC GGC AGA ATA CTT AAG	48
Met Lys Pro Tyr Ala Lys Tyr Ile Trp Leu Asp Gly Arg Ile Leu Lys	
5 10 15	
TGG GAA GAC GCG AAA ATA CAC GTG TTG ACT CAC GCG CTT CAC TAC GGA	96
Trp Glu Asp Ala Lys Ile His Val Leu Thr His Ala Leu His Tyr Gly	
20 25 30	
ACC TCT ATA TTC GAG GGA ATA AGA GGG TAT TGG AAC GGC GAT AAT TTG	144
Thr Ser Ile Phe Glu Gly Ile Arg Gly Tyr Trp Asn Gly Asp Asn Leu	
35 40 45	
CTC GTC TTT AGG TTA GAA GAA CAC ATC GAC CGC ATG TAC AGA TCG GCT	192
Leu Val Phe Arg Leu Glu Glu His Ile Asp Arg Met Tyr Arg Ser Ala	
50 55 60	
AAG ATA CTA GGC ATA AAT ATT CCG TAT ACA AGA GAG GAA GTC CGC CAA	240
Lys Ile Leu Gly Ile Asn Ile Pro Tyr Thr Arg Glu Glu Val Arg Gln	
65 70 75 80	
GCT GTA CTA GAG ACC ATA AAG GCT AAT AAC TTC CGA GAG GAT GTC TAC	288
Ala Val Leu Glu Thr Ile Lys Ala Asn Asn Phe Arg Glu Asp Val Tyr	
85 90 95	
ATA AGA CCT GTG GCG TTT GTC GCC TCG CAG ACG GTG ACG CTT GAC ATA	336
Ile Arg Pro Val Ala Phe Val Ala Ser Gln Thr Val Thr Leu Asp Ile	
100 105 110	
AGA AAT TTG GAA GTC TCC CTC GCG GTT ATT GTA TTC CCA TTT GGC AAA	384
Arg Asn Leu Glu Val Ser Leu Ala Val Ile Val Phe Pro Phe Gly Lys	
115 120 125	
TAC CTC TCG CCC AAC GGC ATT AAG GCA ACG ATT GTA AGC TGG CGT AGA	432
Tyr Leu Ser Pro Asn Gly Ile Lys Ala Thr Ile Val Ser Trp Arg Arg	
130 135 140	
GTA CAT AAT ACA ATG CTC CCT GTG ATG GCA AAA ATC GGC GGT ATA TAT	480
Val His Asn Thr Met Leu Pro Val Met Ala Lys Ile Gly Gly Ile Tyr	
145 150 155 160	
GTA AAC TCT GTA CTT GCG CTT GTA GAG GCT AGA AGC AGG GGA TTT GAC	528
Val Asn Ser Val Leu Ala Leu Val Glu Ala Arg Ser Arg Gly Phe Asp	
165 170 175	
GAG GCT TTA TTA ATG GAC GTT AAC GGT TAT GTT GTT GAG GGT TCT GGA	576
Glu Ala Leu Leu Met Asp Val Asn Gly Tyr Val Val Glu Gly Ser Gly	
180 185 190	
GAG AAT ATT TTC ATT GTC AGA GGT GGA AGG CTT TTC ACG CCG CCA GTA	624
Glu Asn Ile Phe Ile Val Arg Gly Gly Arg Leu Phe Thr Pro Pro Val	
195 200 205	
CAC GAA TCT ATC CTC GAG GGA ATT ACG AGG GAT ACG GTA ATA AAG CTC	672
His Glu Ser Ile Leu Glu Gly Ile Thr Arg Asp Thr Val Ile Lys Leu	
210 215 220	
AGC GGG GAT GTG GGA CTT CGG GTG GAG GAA AAG CCT ATT ACG AGG GAG	720
Ser Gly Asp Val Gly Leu Arg Val Glu Glu Lys Pro Ile Thr Arg Glu	
225 230 235 240	

GAG	GTG	TAT	ACA	GCC	GAC	GAG	GTG	TTT	TTA	GTA	GGA	ACC	GCC	GCA	GAG	768
Glu	Val	Tyr	Thr	Ala	Asp	Glu	Val	Phe	Leu	Val	Gly	Thr	Ala	Ala	Glu	
				245					250					255		
ATA	ACG	CCA	GTG	GTG	GAG	GTT	GAC	GGC	AGA	ACA	ATC	GGC	ACA	GGC	AAG	816
Ile	Thr	Pro	Val	Val	Glu	Val	Asp	Gly	Arg	Thr	Ile	Gly	Thr	Gly	Lys	
			260					265					270			
CCG	GGC	CCC	ATT	ACG	ACA	AAA	ATA	GCT	GAG	CTG	TAC	TCA	AAC	GTC	GTG	864
Pro	Gly	Pro	Ile	Thr	Thr	Lys	Ile	Ala	Glu	Leu	Tyr	Ser	Asn	Val	Val	
		275					280					285				
AGA	GGC	AAA	GTA	GAG	AAA	TAC	TTA	AAT	TGG	ATC	ACT	CCT	GTG	TAT	TAG	912
Arg	Gly	Lys	Val	Glu	Lys	Tyr	Leu	Asn	Trp	Ile	Thr	Pro	Val	Tyr	End	
	290					295					300					

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FIGURE 13

Ammonifex degensii histidinol phosphate aminotransferase

1 ATG GCA GTC AAA GTG CGG CCT GAG CTC AGC CAG GTG GAG ATC TAC CGT CCC GGC AAA CCC 60
 1 Met Ala Val Lys Val Arg Pro Glu Leu Ser Gln Val Glu Ile Tyr Arg Pro Gly Lys Pro 20

 61 ATC GAA GAG GTA AAG AAG GAG CTG GGG CTG GAG GAG GTA GTC AAG CTG GCC TCC AAC GAG 120
 21 Ile Glu Glu Val Lys Lys Glu Leu Gly Leu Glu Glu Val Val Lys Leu Ala Ser Asn Glu 40

 121 AAC CCT CTG GGA CCT TCT CCC AAG GCC GTG GCG GCG CTG GAG GGA CTG GAC CAC TGG CAC 180
 41 Asn Pro Leu Gly Pro Ser Pro Lys Ala Val Ala Ala Leu Glu Gly Leu Asp His Trp His 60

 181 CTT TAC CCA GAA GGC TCA AGC TAT GAG CTA CGG CAG GCG CTG GGT AAG AAA CTG GAG ATA 240
 61 Leu Tyr Pro Glu Gly Ser Ser Tyr Glu Leu Arg Gln Ala Leu Gly Lys Lys Leu Glu Ile 80

 241 GAC CCG GAC AGC ATC ATC GTG GGT TGC GGC TCA AGC GAA GTC ATC CAG ATG CTC TCT TTG 300
 81 Asp Pro Asp Ser Ile Ile Val Gly Cys Gly Ser Ser Glu Val Ile Gln Met Leu Ser Leu 100

 301 GCC CTG CTG GCG CCC GGC GAC GAG GTG GTC ATC CCT GTG CCT ACC TTT CCC CGC TAT GAG 360
 101 Ala Leu Leu Ala Pro Gly Asp Glu Val Val Ile Pro Val Pro Thr Phe Pro Arg Tyr Glu 120

 361 CCC CTG GCA CGG CTC ATG GGG GCT AAT CCC GTA AAA GTT CCC TTG AAG GAC TAC CGC ATC 420
 121 Pro Leu Ala Arg Leu Met Gly Ala Asn Pro Val Lys Val Pro Leu Lys Asp Tyr Arg Ile 140

 421 GAT GTG GAG GCA GTG GCC CGA GCC CTT TCC CCC CGT ACC AAG CTG GTC TAC CTA TGC AAC 480
 141 Asp Val Glu Ala Val Ala Arg Ala Leu Ser Pro Arg Thr Lys Leu Val Tyr Leu Cys Asn 160

 481 CCC AAC AAC CCC ACC GGG ACC ATC GTC ACC CGG GAG GAG GTG GAG TGG TTC TTG GAA AAG 540
 161 Pro Asn Asn Pro Thr Gly Thr Ile Val Thr Arg Glu Glu Val Glu Trp Phe Leu Glu Lys 180

 541 GCG GGG GAG GGG GTT CTC ACC GTG CTG GAC GAG GCC TAC TGC GAG TAC GTG ACC AGC CCC 600
 181 Ala Gly Glu Gly Val Leu Thr Val Leu Asp Glu Ala Tyr Cys Glu Tyr Val Thr Ser Pro 200

 601 GCC TAC CCT GAT GGG CTC GAT TTC CTG CGC CGG GGC TAC AAT GTG GTG GTG CTG CGC ACC 660
 201 Ala Tyr Pro Asp Gly Leu Asp Phe Leu Arg Arg Gly Tyr Asn Val Val Val Leu Arg Thr 220

 661 TTC TCC AAG ATC TAC GGG CTG GCC GGG CTG CGC ATA GGG TAC GGT GTG GCG GAC AGG GAG 720
 221 Phe Ser Lys Ile Tyr Gly Leu Ala Gly Leu Arg Ile Gly Tyr Gly Val Ala Asp Arg Glu 240

 721 CTG GTG GCG GAA CTG CAC CGG GTG CGG GAG CCT TTC AAT GTC AGT TCC GCT GCT CAG ATA 780
 241 Leu Val Ala Glu Leu His Arg Val Arg Glu Pro Phe Asn Val Ser Ser Ala Ala Gln Ile 260

 781 GCC GCC CTG GCC GCC CTG GAA GAC GAA GAG TTC GTG GCG CTT TCG CGC CAG GTC AAC GAA 840
 261 Ala Ala Leu Ala Ala Leu Glu Asp Glu Glu Phe Val Ala Leu Ser Arg Gln Val Asn Glu 280

 841 GAA GGG AAG GTT TTT CTC TAC CGA GAA CTG GAG AGG CGG GGG ATC GCC TAC GTG CCC ACC 900
 281 Glu Gly Lys Val Phe Leu Tyr Arg Glu Leu Glu Arg Arg Gly Ile Ala Tyr Val Pro Thr 300

 901 GAG GCC AAC TTC CTA CTC TTC GAT GCC GGT CGG GAC GAG CAG GAA GTA TTT CGC CGG ATG 960
 301 Glu Ala Asn Phe Leu Leu Phe Asp Ala Gly Arg Asp Glu Gln Glu Val Phe Arg Arg Met 320

 961 CTG CGC CAG GGA GTG ATC ATC CGG GNC GGG GTG GGT TAT CCC ACC CAC TTA AGG GTG ACC 1020
 321 Leu Arg Gln Gly Val Ile Ile Arg Xxx Gly Val Gly Tyr Pro Thr His Leu Arg Val Thr 340

 1021 ATC GGC ACC TTG GAA CAG AAC CAG CGC TTC CTG GAA GCT TTG GAT AAG GCT CTA GAG CTT 1080
 341 Ile Gly Thr Leu Glu Gln Asn Gln Arg Phe Leu Glu Ala Leu Asp Lys Ala Leu Glu Leu 360

 1081 AGG GGG GTT TAA 1092
 361 Arg Gly Val End 364

FIGURE 14

Aquifex aspartate aminotransferase

1 ATG AGA AAA GGA CTT GCA AGT AGG GTA AGT CAC CTA AAA CCT TCC CCC ACG CTG ACC ATA 60
 Met Arg Lys Gly Leu Ala Ser Arg Val Ser His Leu Lys Pro Ser Pro Thr Leu Thr Ile
 61 ACC GCA AAA GCA AAA GAA TTA AGG GCT AAA GGA GTG GAC GTT ATA GGT TTT GGA GCG GGA 120
 Thr Ala Lys Ala Lys Glu Leu Arg Ala Lys Gly Val Asp Val Ile Gly Phe Gly Ala Gly
 121 GAA CCT GAC TTC GAC ACA CCC GAC TTC ATA AAG GAA GCC TGT ATA AGG GCT TTA AGG GAA 180
 Glu Pro Asp Phe Asp Thr Pro Asp Phe Ile Lys Glu Ala Cys Ile Arg Ala Leu Arg Glu
 181 GGA AAG ACC AAG TAC GCT CCC TCC GCG GGA ATA CCA GAG CTC AGA GAA GCT ATA GCT GAA 240
 Gly Lys Thr Lys Tyr Ala Pro Ser Ala Gly Ile Pro Glu Leu Arg Glu Ala Ile Ala Glu
 241 AAA CTA CTG AAA GAA AAC AAA GTT GAG TAC AAA CCT TCA GAG ATA GTC GTT TCC GCA GGA 300
 Lys Leu Leu Lys Glu Asn Lys Val Glu Tyr Lys Pro Ser Glu Ile Val Val Ser Ala Gly
 301 GCG AAA ATG GTT CTC TTC CTC ATA TTC ATG GCT ATA CTG GAC GAA GGA GAC GAG GTT TTA 360
 Ala Lys Met Val Leu Phe Leu Ile Phe Met Ala Ile Leu Asp Glu Gly Asp Glu Val Leu
 361 CTA CCT AGC CCT TAC TGG GTA ACT TAC CCC GAA CAG ATA AGG TTC TTC GGA GGG GTT CCC 420
 Leu Pro Ser Pro Tyr Trp Val Thr Tyr Pro Glu Gln Ile Arg Phe Phe Gly Gly Val Pro
 421 GTT GAG GTT CCT CTA AAG AAA GAG AAA GGA TTT CAA TTA AGT CTG GAA GAT GTG AAA GAA 480
 Val Glu Val Pro Leu Lys Lys Glu Lys Gly Phe Gln Leu Ser Leu Glu Asp Val Lys Glu
 481 AAG GTT ACG GAG AGA ACA AAA GCT ATA GTC ATA AAC TCT CCG AAC AAC CCC ACT GGT GCT 540
 Lys Val Thr Glu Arg Thr Lys Ala Ile Val Ile Asn Ser Pro Asn Asn Pro Thr Gly Ala
 541 GTT TAC GAA GAG GAG GAA CTT AAG AAA ATA GCG GAG TTT TGC GTG GAG AGG GGC ATT TTC 600
 Val Tyr Glu Glu Glu Glu Leu Lys Lys Ile Ala Glu Phe Cys Val Glu Arg Gly Ile Phe
 601 ATA ATT TCC GAT GAG TGC TAT GAG TAC TTC GTT TAC GGT GAT GCA AAA TTT GTT AGC CCT 660
 Ile Ile Ser Asp Glu Cys Tyr Glu Tyr Phe Val Tyr Gly Asp Ala Lys Phe Val Ser Pro
 661 GCC TCT TTC TCG GAT GAA GTA AAG AAC ATA ACC TTC ACG GTA AAC GCC TTT TCG AAG AGC 720
 Ala Ser Phe Ser Asp Glu Val Lys Asn Ile Thr Phe Thr Val Asn Ala Phe Ser Lys Ser
 721 TAT TCC ATG ACT GGT TGG CGA ATA GGT TAT GTA GCG TGC CCC GAA GAG TAC GCA AAA GTG 780
 Tyr Ser Met Thr Gly Trp Arg Ile Gly Tyr Val Ala Cys Pro Glu Glu Tyr Ala Lys Val
 781 ATA GCG AGT CTT AAC AGC CAG AGT GTT TCC AAC GTC ACT ACC TTT GCC CAG TAT GGA GCT 840
 Ile Ala Ser Leu Asn Ser Gln Ser Val Ser Asn Val Thr Thr Phe Ala Gln Tyr Gly Ala
 841 CTT GAG GCC TTG AAA AAT CCA AAG TCT AAA GAT TTT GTA AAC GAA ATG AGA AAT GCT TTT 900
 Leu Glu Ala Leu Lys Asn Pro Lys Ser Lys Asp Phe Val Asn Glu Met Arg Asn Ala Phe
 901 GAA AGG AGA AGG GAT ACG GCT GTA GAA GAG CTT TCT AAA ATT CCA GGT ATG GAT GTG GTA 960
 Glu Arg Arg Arg Asp Thr Ala Val Glu Glu Leu Ser Lys Ile Pro Gly Met Asp Val Val
 961 AAA CCC GAA GGT GCC TTT TAC ATA TTT CCG GAC TTC TCC GCT TAC GCT GAG AAA CTG GGT 1020
 Lys Pro Glu Gly Ala Phe Tyr Ile Phe Pro Asp Phe Ser Ala Tyr Ala Glu Lys Leu Gly
 1021 GGT GAT GTG AAA CTC TCG GAG TTC CTT CTG GAA AAG GCT AAG GTT GCG GTG GTT CCC GGT 1080
 Gly Asp Val Lys Leu Ser Glu Phe Leu Leu Glu Lys Ala Lys Val Ala Val Val Pro Gly
 1081 TCG GCC TTC GGA GCT CCC GGA TTT TTG AGG CTT TCT TAC GCC CTT TCC GAG GAA AGA CTC 1140
 Ser Ala Phe Gly Ala Pro Gly Phe Leu Arg Leu Ser Tyr Ala Leu Ser Glu Glu Arg Leu
 1141 GTT GAG GGT ATA AGG AGA ATA AAG AAA GCC CTT GAA GAG ATC TAA 1185
 Val Glu Gly Ile Arg Arg Ile Lys Lys Ala Leu Glu Glu Ile End

The diagram illustrates the coupled enzymatic reactions for the decarboxylation of L-glutamic acid. It is organized into two main horizontal sections. The top section shows the conversion of an **AMINO ACID** to an α -**KETO ACID**, catalyzed by **T = 70 C, ADP TRANSAMINASE**. This reaction is coupled with the conversion of α -**KETOGLUTARATE** to **L-GLUTAMIC ACID**, which is catalyzed by **PYRIDOXAL PHOSPHATE**. The bottom section shows the conversion of **L-GLUTAMIC ACID** to α -**KETOGLUTARATE**, catalyzed by **T = 37 C** and **GLUTAMATE DEHYDROGENASE**. This reaction is coupled with the conversion of **NADP+** to **NADPH**. A thick downward arrow from **NADPH** points to the word **FLUORESCENCE**, indicating that the production of NADPH is the measurable signal.

FIG. 15